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by

JOSEPH E. ALICATA, Parasitologist

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O. C. MAGISTAD, Director

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JAMES T. JARDINE
Chief, Office of Experiment Stations

D. L. CRAWFORD
President, University of Hawaii

THE GIZZARD-WORM, *CHEILOSPIRURA HAMULOSA* AND ITS TRANSMISSION TO CHICKENS IN HAWAII

by JOSEPH E. ALICATA, Parasitologist

THE PARASITE AND ITS DISTRIBUTION

Gizzard-worms of poultry, *Cheilospirura hamulosa*, are nematodes occurring in the gizzards of chickens and turkeys. These parasites are slender, whitish worms about three-fourths to an inch long. In Hawaii, gizzard-worms were first observed only a few years ago; in a recent survey the writer has found this parasite well established on many poultry farms on the islands of Kauai, ^{Mau}i, Oahu and Hawaii. The losses due to this parasite have not been estimated, but considerable emaciation and anemia have been observed in heavily parasitized birds. One poultryman reported to the writer that in the past few years gizzard-worm infestation was present in all of his birds. In a recent survey in one of the islands mentioned, 18 out of 32 chickens necropsied, or 56 per cent, were infested with gizzard-worms.

PATHOLOGY AND SYMPTOMS

Gizzard-worms have been usually found under the horny lining covering the thinner muscular portion of the gizzard. In light infestations the lining has been found to show only few small dark red ulcerated areas, but in severe infestation the ulceration extended throughout most of the lining. The parasites have been found to produce nodules in the muscle tissue. In some cases this has altered the muscular tissue to such a degree that the gizzard has lost its natural shape. The symptoms of gizzard-worm infestation have been found to vary with the degree of infestation. Mild infestation produces few if any noticeable symptoms, while severe cases produce, as already stated, anemia, emaciation, droopiness and weakness.

LIFE CYCLE AND INTERMEDIATE HOSTS INVOLVED IN THE TRANSMISSION OF THE GIZZARD-WORM TO CHICKENS IN HAWAII

Gizzard-worms require an intermediate host in their life cycle. The gravid females found in the gizzard of the host

deposit daily a large number of eggs which are eliminated from the body with the droppings. Eggs which are ingested by an intermediate host hatch, and the larvae develop to the infective stage (fig. 1) in about 19 to 25 days. When the intermediate host is eaten by the fowl the infective larvae are freed in the bird's gizzard and within 24 hours these larvae penetrate the gizzard. The larvae in the gizzard grow to maturity and in a period of about 90 days the gravid females lay eggs, and thus the life cycle is repeated.

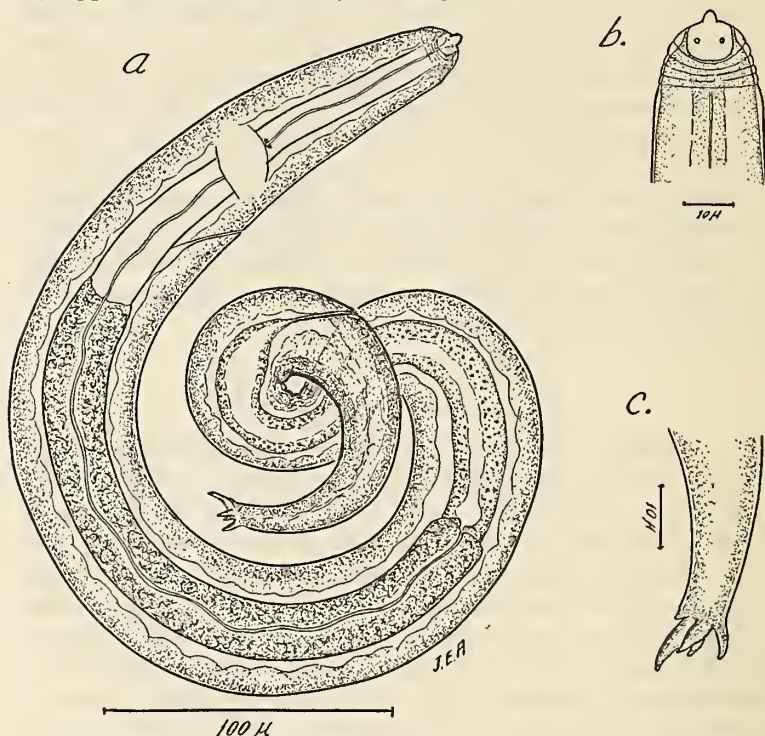


Fig. 1 (a) Infective larva of the gizzard-worm *Cheilospirura hamulosa* recovered from an experimental infected grasshopper; (b) Head end of larva; (c) Tail end of larva.

Previous to the work which is reported in this paper the intermediate host of this parasite in Hawaii was unknown. In the continental United States, Cram [1] reported that grasshop-

[1] ("Developmental Stages of Some Nematodes of the Spiruroidea Parasitic in Poultry and Game Birds" U. S. Dept. Agr. Tech. Bul., 227, Feb. 1931).

pers, *Melanoplus femur-rubrum* and *M. differentialis* could serve as intermediate hosts for *C. hamulosa*. Later, ^{Cuvillier} Cuvillier [2] reported a third species of grasshopper, *Paroxya clavuliger*, capable of serving as an intermediate host. Poultrymen in the continental United States and in Hawaii have from time to time reported gizzard-worm infestation in chickens which had little or no access to grasshoppers. These reports indicated the likelihood of other carriers being responsible for the transmission of the parasite in question.

Recent studies by the writer in Hawaii have shown that the flour beetle, *Tenebroides nana*, the sand hopper, *Orchestia*



Fig. 2 The sand hopper, *Orchestia platensis* (After Williams. The Insects and other Invertebrates of Hawaiian Sugar Cane Fields, 1931).

platensis, and certain species of grasshoppers were naturally infested with gizzard-worm larvae. In a poultry farm on Oahu, 5 percent of *O. platensis* were found naturally infested with gizzard-worm larvae, and in a farm on Maui, 6 percent of the flour beetles, *T. nana*, harbored infective larvae of this nematode.

In connection with these field studies, an experiment was conducted which involved the feeding of about 2,300 grasshoppers, collected in a gizzard-worm endemic area, to 8 laboratory-raised chickens. At the end of 30 days, the chickens were killed and two of the birds were found infested with gizzard-worms. Three control chickens, also laboratory raised, remained free of gizzard-worms. These results indicated that at least some of the grasshoppers that were fed to the chickens harbored infective gizzard-worm larvae.

In addition to the above investigation, various invertebrates have been fed eggs of gizzard-worms in order to infect experimentally known intermediate hosts and to discover other possible carriers of this parasite. As a result of these experimental findings, the following 14 invertebrates have been found to serve as intermediate hosts [3]: (1) Three species of grasshoppers, *Conocephalus saltator*, *Atractomorpha ambigua*, and *Oxya chinensis* (Plate 1), (2) a species

[2] ("A New Intermediate Host for *Cheilosporira hamulosa*, the gizzard-worm of poultry" *J. Parasitol.*, V. 19 (3): 244-245, 1933).

[3] The writer is indebted to Dr. C. T. Schmidt of the University of Hawaii, Dr. F. X. Williams of the Hawaiian Sugar Planters' Association, Dr. E. A. Chapin of the U. S. National Museum and Mr. W. S. Fisher of

of amphipod, *Orchestia platensis*, commonly known as "sand hopper" (fig. 2); and (3) ten species of beetles, as follows: (a) flour beetles, *Tribolium castaneum*, *Tenebroides nana*, and *Carpophilus dimidiatus* (Plate 2); (b) beetles found around poultry manure, *Dactylosternum abdominale*, *Palorus ratzeburgi*, *Typhaea stercorea*, *Litargus balteatus*, and *Euxestus* sp.; (c) weevils, *Oxydema fusiforme* and *Sitophilus oryzae*.



Plate 1 Some of the common grasshoppers found to serve as intermediate hosts for the Gizzard-worm, *Cheilospirocha hamulosa*:

A. *Conocephalus saltator* B. *Atractomorpha ambigua* C. *Oxya chinensis*

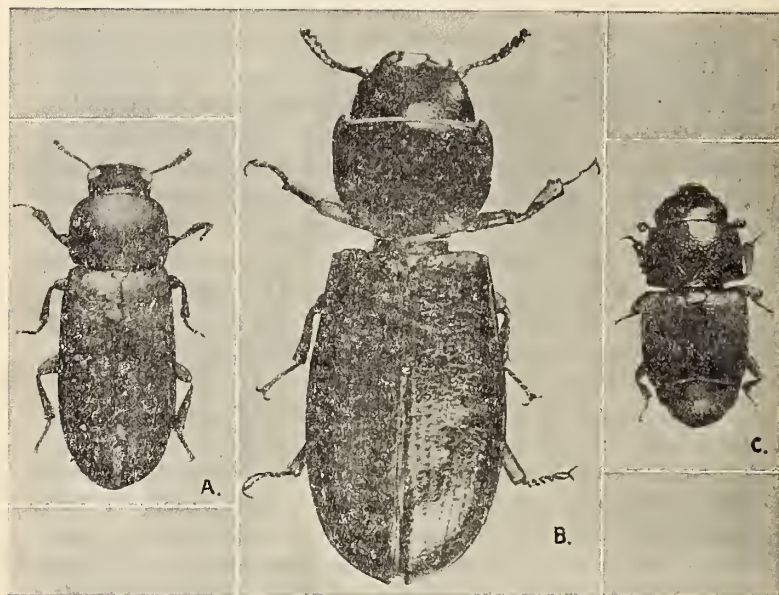


Plate 2 Beetles found to serve as intermediate hosts for the gizzard-worm, *Cheilospirocha hamulosa*:

A. *Tribolium castaneum* B. *Tenebroides nana* C. *Carpophilus dimidiatus*

the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, for identifying the insects, and to Dr. M. A. Miller of the University of Hawaii for identifying the amphipod reported as an intermediate host.

DISTRIBUTION OF THE INTERMEDIATE HOSTS

All the intermediate hosts reported in this paper have been collected on the islands of Kauai, Oahu, Maui and Hawaii. The common long-horned meadow grasshopper, *Conocephalus saltator*, and the short-horned grasshopper, *Oxya chinensis* and *Atractomorpha ambigua* have been found of common occurrence in poultry farms in areas where weeds were common.

The amphipod *Orchestia platensis* known as the "sand hopper" or "sand shrimp," is very common in poultry yards especially in damp or wet areas around water fountains and under wet and decaying lumber or vegetation.

The flour beetles and weevil, which usually infest grains and milled products of starchy nature, have also been found in feed storerooms, chicken houses, nest boxes and feeding troughs. Other manure feeding beetles reported in this paper have been found in large numbers under poultry houses where the chicken droppings are allowed to accumulate.

SUMMARY AND CONCLUSIONS

Previous to this report the carriers for the gizzard-worm in Hawaii were unknown. Recent investigations by the writer have shown that the flour beetle, *Tenebroides nana*, and the sand hopper, *Orchestia platensis*, collected from poultry farms in the Territory of Hawaii have been found naturally infested with the infective larvae of the poultry gizzard-worm, *Cheilospirura hamulosa*. Out of 8 laboratory-raised chickens to which there were fed about 2,300 grasshoppers that had been collected in an endemic gizzard-worm area, two became infested with gizzard-worms.

The invertebrates which have been experimentally determined to serve as intermediate hosts for the gizzard-worm are: Three species of grasshoppers, a species of sand hopper and ten species of beetles.

On the basis of the above finding it follows that control measures for gizzard-worms involve mainly frequent removal of chicken manure from the poultry yards and prevention of fowls from eating beetles, grasshoppers and sand hoppers.

